Game Engines from Scratch

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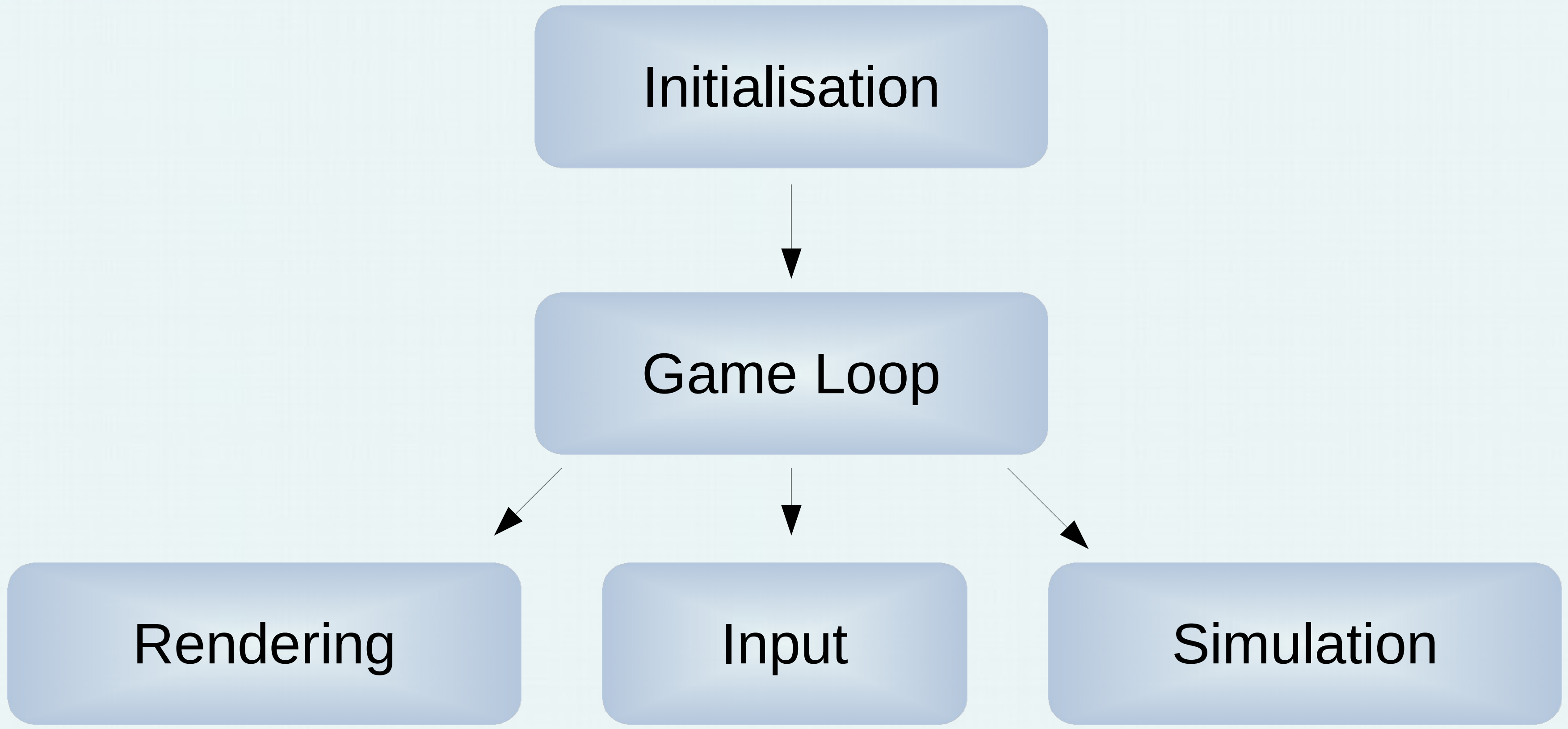
Why DIY?

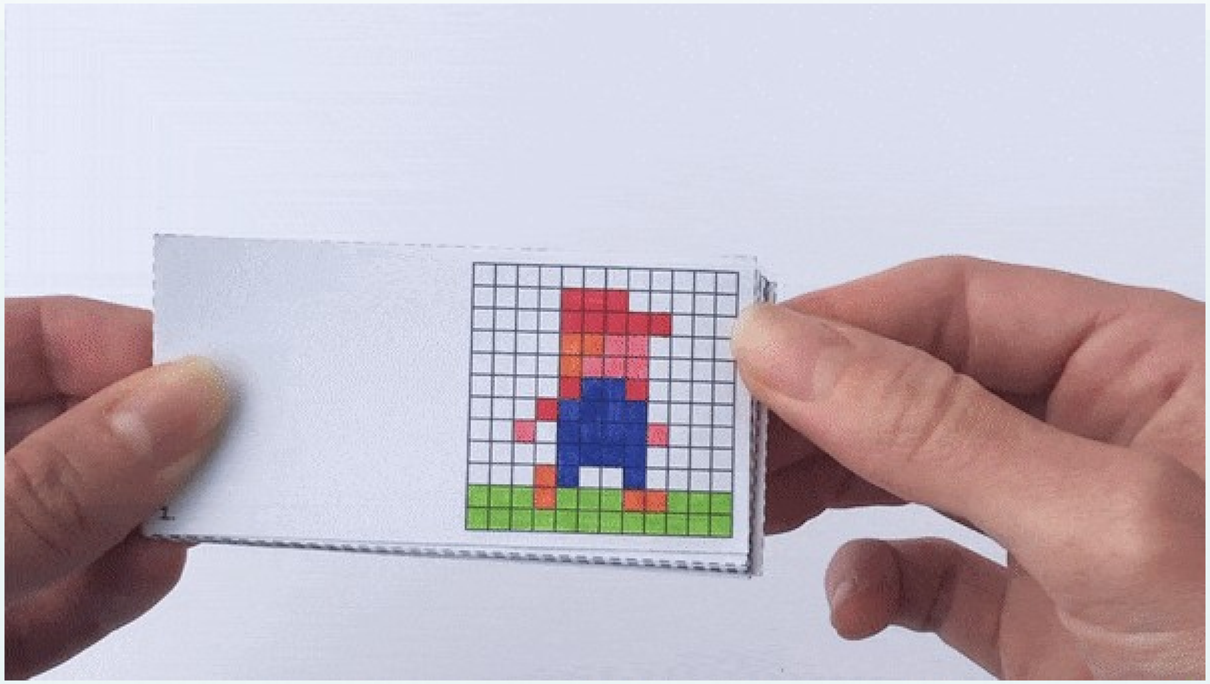
- You were dropped as a baby
- You want to gain XP
- Portfolio piece (non/technical bridge)
- You want to build a good game
- Your game has unique requirements

  (UE5/Unity/Swarm Engine)

General Architecture



Rendering/Simulation Decouple



Rendering
- renders scene
- governs FPS (deltaTime)

Simulation
- runs whole sim
- completes each frame

Architecture Walkthrough

- Sand Sim Engine
- Mr Blue Square

OOP & DOD

Object Oriented Programming

```
Class Car {
    int ID;              // 4 bytes
•   Color Colour;        // 8 bytes
•   byte Wheels;         // 1 byte
•   float BrakeForce;    // 2 bytes
•   float Velocity;      // 8 bytes
•   bool IsBraking;      // 1 bit
}

Function ApplyBrakes(Car car) {
    if (car.IsBraking) {
      car.Velocity -= car.BrakeForce;
    }
}
Array<Car> Cars = [Car1, Car2, Car3, ...];

for (int i = 0; i < Cars.length; i++) {
    ApplyBrakes(Cars[i]);
}
```

Data Oriented Design

```
Struct Cars{
    int[] IDs;              // 4 bytes each
    Color[] Colours;        // 8 bytes each
    byte[] Wheels;          // 1 byte each
    float[] BrakeForces;    // 2 bytes each
    float[] Velocities;     // 8 bytes each
    bool[] IsBraking;       // 1 bit each
}
Function ApplyBrakes(float[] velocities, float[] brakeForces, bool[] isBraking) {
    for (int i = 0; i < velocities.length; i++) {
        if (isBraking[i]) {
            velocities[i] -= brakeForces[i];
        }
    }
}

Cars cars = {
    IDs: [0, 1, 2, 3],
    IsBraking: [true, true, false, true],
    Colours: [Red, Blue, Green, Yellow],
    Wheels: [4, 4, 3, 4],
    BrakeForces: [2.0, 1.6, 2.2, 1.8],
    Velocities: [70.0, 50.0, 60.0, 80.0]
};
BreakingCars = [0,1,3];
ApplyBrakes(BreakingCars.Velocities[id], BreakingCars.BrakeForces[id]);
```

OOP & DOD
In Memory

Object

Size =	23.1b
Useful Size =	10.1b
Used Size =	23.1b
Wasted =	13b

Entity

Size =	23.1b
Useful Size =	10.1b
Used Size =	10.1b
Wasted =	0

What’s Next?

- Wave Function Collapse
- Gamified Neural Net Interface

Thank you!

Github

Youtube

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